CLAIMS:

1. Positioning apparatus, especially for measuring machines, manufacturing machines or the like, comprising at least one position sensor (12), at least one position controller (13) and at least one position actuator (14), wherein the or each position sensor (12) measures the position of a position-controlled device (11), wherein the or each position controller (13) uses measurement signals provided by the or each position sensor (12) as input signals, and wherein output signals generated by the or each position controller (13) are used by the or each position actuator (14) to control the position of said position-controlled device (11), the positioning apparatus further comprising gravity compensation means compensating gravitational forces acting on said position-controlled device (11), characterized in that the gravity compensation means comprises at least one gravity compensation controller (16; 25, 28) and at least one gravity compensation actuator (17), wherein the or each gravity compensation controller (16; 25) uses the output signals generated by the or each position controller (13) as input signals, thereby generating output signals used by the or each gravity compensation actuator (17) to compensate gravitational forces acting on said position-controlled device (11).

2. Positioning apparatus according to claim 1, characterized in that the gravity compensation actuator (17) comprises spring means (18), string means (19), pulley means (20) and motor means (21).

3. Positioning apparatus according to claim 2, characterized in that the spring means (18) is attached with a first end preferably to the position-controlled device (11) and with a second end to the string means (19).

4. Positioning apparatus according to claim 2 or 3, characterized in that the string means (19) is wound around the pulley means (20), wherein the pulley means (20) is driven by the motor means (21), and wherein the motor means (21) is controlled by the output signals generated by the gravity compensation controller (25; 28).

5. Positioning apparatus according to any one of the preceding claims 2 to 4, characterized in that the pulley means (20) is driven by the motor means (21) in a way that the tension in the spring means (18) is kept constant and equal to the gravitational forces acting on said position-controlled device (11).

6. Positioning apparatus according to any one of the preceding claims 1 to 5, characterized in that the gravity compensation means comprise one gravity compensation controller (16), wherein the output signals of said one gravity compensation controller are used to control the gravity compensation actuator (17).

7. Positioning apparatus according to any one of the preceding claims 1 to 5, characterized in that the gravity compensation means comprise two gravity compensation controllers, wherein a first gravity compensation controller (25) uses the output signals generated by the position controller (13) as input signals, wherein a second gravity compensation controller (28) uses the output signals generated by the first gravity compensation controller (25) as input signals, and wherein output signals from said second gravity compensation controller (28) are used to control the gravity compensation actuator (17).

8. Positioning apparatus according to claim 7, characterized in that the output signals generated by the first gravity compensation controller (25) are summed with a position setpoint signal of said position controller (13), wherein the resulting signal is used as setpoint for said second gravity compensation controller (28).

9. Positioning apparatus according to claim 7 or 8, characterized in that the second gravity compensation controller (28) uses the measurement signal of a motor position sensor (29) as input signal, wherein said motor position sensor measures the position of the motor means (21) of said gravity compensation actuator (17).

10. Gravity compensation device for compensating gravitational forces acting on a position-controlled device (11), wherein the position of said position-controlled device (11) is measured by at least one position sensor (12) and controlled by at least one position controller (13), characterized by at least one gravity compensation controller (16; 25, 28) and at least one gravity compensation actuator (17), wherein the or each gravity compensation

controller (16; 25) uses the output signals generated by the or each position controller (13) as input signals, thereby generating output signals used by the or each gravity compensation actuator (17) to compensate gravitational forces acting on said position-controlled device (11).

11. Gravity compensation device according to claim 10, characterized in that the gravity compensation actuator (17) comprises spring means (18), string means (19), pulley means (20) and motor means (21).

12. Gravity compensation device according to claim 11, characterized in that the spring means (18) is attached with a first end preferably to the position-controlled device (11) and with a second end to the string means (19).

13. Gravity compensation device according to claim 11 or 12, characterized in that the string means (19) is wound around the pulley means (20), whereby the pulley means (20) is driven by the motor means (21), and whereby the motor means (21) is controlled by the output signals generated by the gravity compensation controller (16; 28).

14. Gravity compensation device according to claim 11, 12 or 13, characterized in that the pulley means (20) is driven by the motor means (21) in a way that the tension in the spring means is kept constant and equal to the gravitational forces acting on said position-controlled device (11).

15. Gravity compensation device according to any one of the preceding claims 10 to 14, characterized by one gravity compensation controller (16), whereby the output signals from said one gravity compensation controller (26) are used to control the gravity compensation actuator (17).

16. Gravity compensation device according to any one of the preceding claims 10 to 14, characterized by two gravity compensation controllers, wherein a first gravity compensation controller (25) uses the output signals generated by the position controller (13) as input signals, wherein a second gravity compensation controller (28) uses the output signals generated by the first gravity compensation controller as input signals, and wherein

output signals from said second gravity compensation controller (28) are used to control the gravity compensation actuator (17).

17. Gravity compensation device according to claim 16, characterized in that the output signals generated by the first gravity compensation controller (25) are summed with a position setpoint signal of said position controller (13), whereby the resulting signal is used as setpoint for said second gravity compensation controller (28).

18. Gravity compensation device according to claim 16 or 17, characterized in that the second gravity compensation controller (28) uses the measurement signal of a motor position sensor (29) as input signal, whereby said motor position sensor measures the position of the motor means (21) of said gravity compensation actuator (17).

19. Method for compensating gravitational forces acting on a position-controlled device, whereby the position of said position-controlled device is measured by at least one position sensor and controlled by at least one position controller, characterized in that at least one gravity compensation controller uses output signals generated by the or each position controller as input signals thereby generating output signals used by at least one gravity compensation actuator to compensate gravitational forces acting on said position-controlled device.

20 Method according to claim 19, characterized in that the gravity compensation actuator comprises spring means, string means, pulley means and motor means, whereby the spring means is attached with a first end to the position-controlled device and with a second end to a string means, wherein the string means is wound around the pulley means, and wherein the pulley means is driven by the motor means using the output signals generated by the gravity compensation controller in a way that the tension in the spring means is kept constant and equal to the gravitational forces acting on said position-controlled device.

21. Method according to claim 19 or 20, characterized in that one gravity compensation controller is used, whereby the output signals of said one gravity compensation controller are directly used to control the gravity compensation actuator.

22. Method according to claim 19 or 20, characterized in that two gravity compensation controllers are used, wherein a first gravity compensation controller uses the output signals generated by the position controller as input signals, wherein a second gravity compensation controller uses the output signals generated by the first gravity compensation controller as input signals, and wherein output signals of said second gravity compensation controller are used to control the gravity compensation actuator.

23. Method according to claim 22, characterized in that output signals generated by the first gravity compensation controller are summed with a position setpoint signal of said position controller, whereby the resulting signal is used as setpoint for said second gravity compensation controller, and the second gravity compensation controller uses the measurement signal of a motor position sensor as input signal, whereby said motor position sensor measures the position of the motor means of said gravity compensation actuator.